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**From:** Brasaemle, Karla [Karla.Brasaemle@TechLawInc.com]  
**Sent:** 7/6/2017 3:51:10 PM  
**To:** LEE, LILY [LEE.LILY@EPA.GOV]  
**CC:** Nguyen, Lyndsey [Nguyen.Lyndsey@epa.gov]  
**Subject:** RE: soil variability

That might work if we knew what the characteristic ratios for serpentinite soils at Hunters Point actually were. I don't think we can rely on it without knowing that we have reliable (unfalsified) ratios from actual serpentinite soils.

Karla Brasaemle, P.G.  
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**From:** LEE, LILY [mailto:LEE.LILY@EPA.GOV]  
**Sent:** Wednesday, July 05, 2017 10:39 PM  
**To:** Brasaemle, Karla  
**Cc:** Nguyen, Lyndsey  
**Subject:** RE: soil variability

Thanks! Lyndsey was wondering if comparing ratios of Ra-226 vs Th-232 (or Bi-214 vs Ac-228) would be a reliable way to detect falsification through selective collection of serpentinite soils. If the ratios were more consistent in some SU's, then should we flag those for re-sampling? How reliable would that be?

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**From:** Brasaemle, Karla [mailto:Karla.Brasaemle@TechLawInc.com]  
**Sent:** Wednesday, July 5, 2017 10:34 PM  
**To:** LEE, LILY <LEE.LILY@EPA.GOV>; Nguyen, Lyndsey <Nguyen.Lyndsey@epa.gov>  
**Subject:** soil variability

Hi Lily,

Sorry, my work phone quit working, so I just got your message.

The soils are quite variable. Most soil is fill, but very little of it is actually crushed green stone (or serpentinite). Soil types can vary over a few feet (Hunters Point is mostly fill, so imagine that the Navy accepted a few dump truck loads from numerous sources. At some sites, it is pretty jumbled (IR Site 25) and appears to be vertical piles adjacent to each other, while at in some areas it appears that the soil was spread out in layers (IR 7/18, northern parts of IR-28). In some cases, bedrock is chert, not serpentinite (and soil derived from it would be crushed red rock, not green). There are also layers of naturally occurring Bay Mud (clay) and sand (often has shells in it), but those are typically pretty localized. Probably 85 or 90% of Hunters Point land is "fill."

In order to install some of the storm drains and sanitary sewers, they cut into bedrock. In those cases, the storm drains and sanitary sewer piping should have been laid on sand or finely crushed rock (genesis unknown, but possibly from a quarry). There were a couple of pipelines or drains on Parcel A where the underlying material was Black Beauty abrasive blast material (It was dug out because of the NORM), but in general this was not the rule – we were told at several meetings that very little Black Beauty was found during the SD/SS removals.

Does this answer the question?

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